it may not be quite accurate, but it gives in most cases a very fair approximation. The method (page 104) of cleaning the bulb and stem of mercurial thermometers, with boiling nitric acid before filling, has not yet, so far as we know, been generally adopted.

Chapter iv. deals with Calorimetry. The general notion of a quantity of heat introduced in the first chapter is here used without further discussion of what is essentially implied in it. This leaves it on a not altogether satisfactory basis. The notion as first brought in is somewhat metaphysical :

> " In order to account for the sensation experienced in presence of a hot body, an active agent is postulated and the name given to this agent is heat." (p. 21.)

This is hardly the ground, or the kind of ground, on which the idea of heat as a measurable quantity rests. We need to recognise that objects which can give rise to the sensation of heat can also produce various measurable effects—can melt ice, for instance ; that the power to produce these effects is communicable from one body to another ; that, unless there is expenditure of some form of energy, such power when possessed by one body is exhausted in proportion as it is transferred to others ; and so on.

It is much to be desired that writers on physics would make a point of following, whenever possible, the precise and carefully considered terminology adopted by Prof. Everett in " The C.G.S. System of Units." They would not then speak of *thermal capacity* and *specific heat* as though they meant the same thing.

A useful part of this chapter is a good description, with figures, of Joly's condensation-method of calorimetry.

Chapter v., extending to more than 170 pages, is devoted to " Change of State." It contains valuable discussions of the properties of bodies at and near the ' critical point " and the equations by which Van der Waals and Clausius have attempted to express generally he properties of fluids in relation to pressure, volume, and temperature.

This chapter contains much valuable matter that has not previously been made so fully accessible to English students. We are, however, rather surprised not to find any reference to the experiments of Rudorff, Guthrie, Raoult and others on the effect of substances in solution on the freezing points and vapour-pressures of liquids, nor to Van t'Hoff's theoretical discussion of such results. Another even more important omission is any mention of the liquefaction by Cailletet and Pictet of what everybody used to call, and Mr. Preston still calls, the permanent gases. As a natural consequence there is no reference to the determination of the boiling points and critical points of several of these gases by Wroblewski and Olzewski.

Chapter vi. is on " Radiation." The most novel matters included in it are descriptions and figures of Prof. Langley's bolometer and Prof. Boys's radiomicrometer.

In chapter vii., on " Conduction," we must point out a very good description and discussion of Angström's method (alternate heating and cooling) of determining the conductivity of metals.

Chapter viii., on " Thermodynamics," we are inclined to think the most valuable in the book, in the sense that it contains a specially large amount of important matter that has never before been readily accessible to English students. The section on the dynamical equivalent of heat includes the recent results of Miculescu and of Mr. E. H. Griffiths, as well as a full description of Rowland's experiments, which ought years ago to have attracted more attention in this country than they seem to have done. In the theoretical part of this chapter the author has, in the main, followed Clausius's method of presentation, but he has included admirable expositions of Massieu's Characteristic Function, of Duhem's Thermodynamic Potential, of the allied work of Gibbs, and of the last author's geometrical treatment of thermodynamic questions.

Notwithstanding omissions, some of which we have mentioned, every chapter affords evidence of care in looking up authorities and collecting material. But the value of the book as a work of reference might be a good deal increased by more numerous and more extended tables of numerical results. For some reason French books are quoted very largely, and not only for the work of Frenchmen ; even Tredgold is referred to in a French translation.

If, in the course of the above notice, criticism seems to be more prominent than commendation, we should do injustice to ourselves, as well as to the author, if we did not say distinctly that, in our opinion, he has produced a very valuable and useful book which we earnestly recommend to all serious students of the subject. When an author obviously aims at a high standard, he invites a critic to adopt a similar standard. And in a short notice such as this, fault-finding necessarily occupies a disproportionate space as compared with praise : if we find fault, it is only fair to particularise, whereas praise applicable to hundreds of pages can be put into a very few words.

We ought to add that printing, paper, and wood-cuts are all excellent, and for a book of so many pages there are very few misprints. The index has one rather irritating characteristic, which, however, is by no means peculiar to this work. If we wish to know what has been done on a given subject by a particular author, we very likely find his name followed by references to ten or a dozen different pages, but without anything to show on which, if on any of them, we shall find the matter we want.

It may perhaps save some reader trouble if we point out that, on p. 202 (in " Cor. 2 "), λ, μ, ν are printed instead of α, β, γ, and on p. 588, the column headed " C.G.S. System " should be headed Kilogramme-metres.

G. Carey Foster.

AN EDUCATIONAL ATLAS.

Philip's Systematic Atlas, Physical and Political, specially designed for the use of Higher Schools and Private Students. By E. G. Ravenstein. (London : George Philip and Co., 1894.)

THE chief claim of this atlas to consideration, as indicated in the title, is the careful design and plan of construction ; the order and selection of the

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maps, their scale and mode of colouring being, it is stated, based on a definite system. The work is one of Philip's Geographical Series, which is edited jointly by Mr. Ravenstein, Mr. J. Scott Keltie, and Mr. Mackinder.

An admirable discussion of projections, scales, and measurement on maps with diagrams, is the most interesting part of the introductory text, and these difficult questions are handled with rare conciseness and clearness. The name of the projection and the natural scale are given for every map—a most useful innovation. An original diagram, showing the relative heights, depths, and curvature of the surface of the globe along the equator, and the parallels 30°, 45°, and 60° N. and S. gives a very striking view of the vertical relief of the earth. Ten plates are devoted to general physical geography, and although the scale is small, and the features consequently much generalised, they are clear and satisfactory. The rainfall maps on plate 5 are particularly interesting, including two which are entirely new, representing the average number of rainy days in different parts of the world, and the relative humidity of the atmosphere. Equal praise cannot be given to the maps dealing with the distribution of plant and animal life, the names on which are frequently puzzling, and the species selected for treatment curiously unequal.

The maps of continents and countries, which make up the bulk of the atlas, show configuration by a combination of contour lines and tints with hill-shading. Here we regret that Mr. Ravenstein had not courage to disregard the conventional strong green tint for the lowlands, and to adopt an unbroken system of deepening shades of brown. It is noticeable, also, that the application of the green tint is unsystematic, extending to 300 feet in some maps, to 600 in others, and in one at least to 3000 feet above sea-level. A similar break in the system of indicating density of population is sure to give rise to confusion; the same shade being used to represent regions of over 512 inhabitants to the square mile in Europe, those over 256 in Asia, over 64 in Africa, and over 32 in America. There are several minor defects visible in the maps, such as the omission of links in the through railway system, and difference in the representation of county-boundaries in the maps of England and Scotland, but these are not more frequent than in atlases of much greater pretensions, and will of course disappear in a new edition. The colour-printing of many of the maps may also be improved.

A great feature of the work is the number of inset maps, garnishing the margins of larger plates with enlargements of regions of special interest, or small-scale general maps showing geology, climate, vegetation, race, language, or density of population. In this way the fact that there are as many maps as there are sciences involving distributions is kept to the front, and the teacher or scholar using this atlas is led to see that geography is no haphazard agglomeration of disconnected details, but a shapely system incorporating and elucidating the results of all departments of nature-study. We know of no atlas in any language in which the systematic plan has been more successfully elaborated, the exceptions we have noted above being thrown into undue prominence by the general excellence of the whole.

OUR BOOK SHELF.

Life and Rock: a Collection of Zoological and Geological Essays. By R. Lydekker, B.A., F.G.S., &c. *Knowledge* Series. (London: Universal Press, 1894.)

MR. LYDEKKER'S name is well known as that of a popular exponent of the results of zoological and palæontological research. The essays which he collects under the title of "Life and Rock," and which deal with a wide range of zoological subjects, from elephants to what he terms "forams," will serve to sustain his reputation in this respect. Mr. Lydekker's chief aim is to convey information which shall not be couched in terms so technical as to discourage those who have neither the inclination nor the desire to become serious students. In this he is eminently successful. His language is simple, clear and direct, without any attempt at a distinctive style; and he shows good judgment in drawing the line beyond which his readers would not be able to follow him, nor care to make any effort to do so. Above all he is accurate, and his information may be relied on as up to date. We question, however, his wisdom of speaking in a book of this popular kind of "those writers who explain evolution by some mode of what *they are pleased to call* natural selection"; and of "those who put their faith in a mode of evolution dependent only upon *so-called* natural causes." Let us by all means have the best and most forcible available criticism on natural selection as a valid explanation of the observed facts of organic nature and on the evolution of living and extinct beings by processes which are termed natural. Such criticism is the very life of science. But the words we have italicised are mere side-thrusts, which do the reader no good, and the writer no credit.

Disease and Race. By Jadroo. (London: Swan Sonnenschein and Co., 1894.)

"TO show some continuity in disease, to evolve a little order out of the existing chaos," these were the objects which led the author to write this book. He collects inoculable diseases, and arranges them in a genealogical table, which is suggestive, to say the least of it. Tuberculosis is shown to be descended directly from scrofula, and scrofula from syphilis, which in turn is regarded as having descended from leprosy. Other diseases are supposed to be connected in a similar manner, though the grounds upon which the supposition is based are not very firm in many cases. The chief point to which the arguments lead is that "every contagious or infectious disease, by either the formation of a hybrid, or by hereditary transmission of the individual modification, tends to eradicate itself." The author is strongly in favour of the establishment of institutes for the purpose of research into the bacteriology, etiology, epidemicity, and sequence of diseases. As there is a dearth of human subjects upon which to experiment, he suggests that convicted murderers should be given the option of death or the probability of leading a comparatively comfortable existence in a bacteriological institute. It has been said that "the worst use you can put a man to is to hang him"; and certainly, if a murderer were used as a medium for the cultivation of bacteria, he would expiate his offence in a very suitable manner.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected anuscripts intended for this or any other part of* NATURE. *o notice is taken of anonymous communications.*]

The Mass of the Earth.

THIS month's *Philosophical Magazine* contains an interesting, instructive, and suggestive, criticism of Prof. Poynting's

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